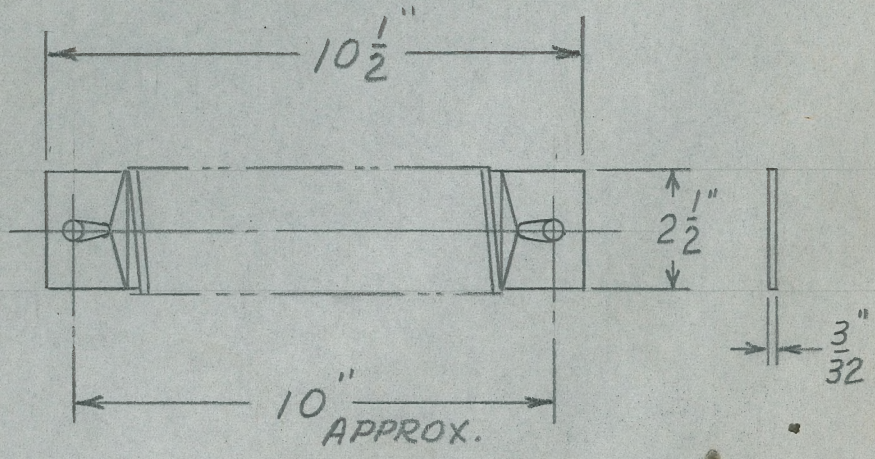
LOCKE INSULATORS

U-SK12-5-75-FCV

REVISIONS		
0	R 305	11-21-75
	DEC. 5, 1975	

TITLE

CARD RESISTOR - NON-INDUCTIVE



Mounting Hole 1/4" dia

PRINTS TO

MADE BY EHW	LOCKE INSULATORS, INC.	U-SK12-5-75-FCV
APPROVALS	BALTIMORE, MARYLAND 21230	

V5C74 PRINTED IN U.S.A. K&E 10 7155 6-74 MC 2555•

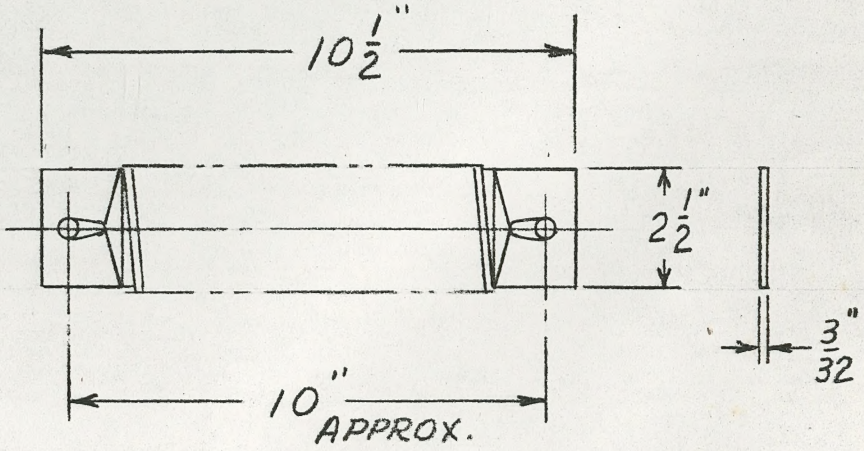
REVISIONS		
0	R-305	11-21-75
	DEC. 5, 1975	

LOCKE INSULATORS

U-SK12-5-75-FCV

TITLE

CARD RESISTOR - NON-INDUCTIVE



Mounting Hole 1/4" dia

PRINTS TO

MADE BY EHW	LOCKE INSULATORS, INC.	U-SK12-5-75-FCV
APPROVALS	BALTIMORE, MARYLAND 21230	

V5C74 PRINTED IN U.S.A. K&E 10 7155 6-74 MC 2555•

September 27, 1976

Mr. William Fields
Building 42-2C
General Electric Company
100 Woodlawn Avenue
Pittsfield, Massachussets 01201

Dear Bill:

In accordance with our telephone conversation this past week, I would appreciate your giving us a quotation on making up noninductive resistor cards for use with our impulse generator, as follows:

Number	Resistance (ohms)
25	30
25	60
25	125
25	200
25	250
10	375

We have found that wire wound on a fiberglass material is quite satisfactory and does resist breakage to a considerable degree.

I am enclosing a sketch #U-SK12-5-75 FCV, which shows the dimensions of the cards we need.

Please call me if you have any questions on Dial Comm: 8*272-9235. Thank you for your cooperation.

Very truly yours,

F. C. Vose
Manager-High Voltage
Laboratory

FCV/lan
enclosure

SWITCHING SURGE CIRCUIT FOR LOCKE

The circuit for switching impulse testing is a modified lightning impulse testing circuit, as shown in Fig. 2. Salient modifications are:

- The tail resistance R_g and the resistance divider R_d are removed from the circuit. The long switching impulse tail is then formed by allowing the generator to discharge through the charging resistors R_c.
- The series resistance R_s is increased to produce the desired time to crest.
- The load capacitor C_L should be of the order of 1000 pF so that the series resistance does not become abnormally large.
- The load capacitor is used to form a capacitance voltage divider by connecting a low voltage, high capacitance capacitor between its lower end and ground.
- The load capacitor retains some charge following a switching impulse because the output gap of the generator stops conducting before the generator and C_L are completely discharged. This retained charge will cause the measurement of voltage on the next impulse to be somewhat incorrect. To circumvent this effect, bleeder resistors are connected in parallel with the load capacitors.

Load Capacitors (C_L)

It is recommended that this be made up of (5) 138 kV coupling capacitors, Cat. No. 4CW35C5. Stacked in series, these will have a capacitance of about 1020 pF and an internal switching impulse strength of greater than 2400 kV. Each capacitor is 52-1/4 inches tall; therefore the height of the stack will be 261 inches. The stack will be mounted on an insulator of about one foot high similar to the arrangement of the present RIV capacitor stack. The positive polarity critical flashover voltage will be 1600 to 1700 kV. This could be increased to

about 2000kV by mounting the stack on a pedestal 7 ft. high. However, the strike distance from the impulse generator to the wall is 19.2 ft. and to the roof girders, 19.4 ft. The positive polarity CFO for these distances is about 1400 to 1500 kV, so there would be no advantage to putting the C_L on a pedestal.

On negative polarity it will be possible to work up to 2400 kV.

Series Resistance (R_S)

The standard switching impulse has a front of 250 $\pm$ 50 μs and a tail of 2500 $\pm$ 1500 μs.

With the proposed C_L of 1020 pF, a series resistance of 50 kilo-ohms is required to produce the 250 μs front. This will consist of (50) 1000 ohm IRC resistors, Type RW11(175W). These resistors will operate satisfactorily at 50 kV so that 50 will be adequate for 2500 kV. It is proposed that 40 be installed in the generator and 10 external to the generator.

The resistors have ferrules so that they can be snapped into fuse clips like the present charging resistors. They are slightly shorter (9.5") than the present lightning impulse cards. It is suggested that fuse clips like those used for the charging resistors be installed in such a way that the switching impulse resistors and lightning impulse resistors can both be in place during lightning impulse tests and the latter be removed for switching impulse tests.

The (10) external resistors will be slipped onto a nylon or polypropylene rope. The rope is stretched and clamps attached to the rope at both ends. This keeps the ferrules in contact. Connection leads are attached to the ferrules at either end of the (10) resistors. The external resistors will be suspended from the impulse generator as the lightning impulse resistor now is.

Charging Resistors (R_C)

The present charging resistors are 5 kilo-ohms. They will need to be increased to 15 kilo-ohms in order to obtain a tail of 2500 to 3000 μs.

Capacitance Voltage Divider (C_L and C_2)

The C_2 capacitor in Figure 1 is used to control the ratio of the capacitance divider. It is proposed to establish ratios of approximately 8000, 5000, 3000, 2000, 1200. These will be used in the following manner.

A precision DC voltage supply will be used to provide a bias to the vertical deflection plates of the oscilloscope. This can be used to make accurate visual measurements of the voltage without taking oscillograms. For example, if the expected input voltage to the deflection plates is +450 volts, the bias is set to -450 volts. The operator then observes where the crest of the impulse is with respect to the zero line of the oscilloscope. If it coincides with the zero line, the impulse deflection is 450 volts. If it is 0.1 division low, the voltage is 450 - (0.1 x 50) or 445 volts. Reading accuracies of approximately 1% can be achieved.

When oscillograms are required, a lower input voltage and a lower bias voltage are used. The input voltage in this case will usually be in the range of 200 to 300 volts and the bias voltage in the range of 100 to 200 volts. In this case the internal bias can also be used in place of the external DC supply. The divider ratios will be used as shown below.

	Visual Reading		Oscillograms	
Test kV	Ratio	Oscil. Input Voltage	Ratio	Oscil. Input Voltage
2400 to 1500	5000	480 to 300	8000	300 to 188
1500 to 900	3000	500 to 300	5000	300 to 180
900 to 600	2000	450 to 300	3000	300 to 200
600 to 400	1200	500 to 330	2000	300 to 200

C_2 Capacitor

The ratio of a capacitance divider is

$$\text{Ratio} = \frac{C_1 + C_2}{C_1}$$

and where $C_2 \gg C_1$

$$\text{Ratio} = \frac{C_2}{C_1}$$

The exact value of C_1 will have to be determined after the capacitors have been acquired. It should be close to 1020 pF. Using this value, the C_2 capacitances will be:

Ratio	C_2 (uF)	
8000	8.16	(5 & 3 in parallel)
5000	5.1	
3000	3.06	
2000	2.04	
1200	1.22	

The C_2 capacitors are mounted in a 3" x 4" x 5" minibox as shown in photographs 1 and 2 and Figure 2. The parts are as follows:

1. Capacitors
2. Bleeder Resistor
3. Banana Plug Receptacle - Insulated
4. Banana Plug Receptable - Grounded
5. Lead to Amphenol Connectors
6. Ground Collector Ring
7. Tabs of Collector Ring
8. Amphenol Female Connector
9. 1/4 x 20 Bolts and Nuts

The connection from C_1 to C_2 is made via the insulated banana plug receptacle, item 3. The connection to ground is made via the 1/4-20 bolt and nut, item 9. The capacitors, several in parallel, are arranged in a circular bundle, item 1. At one end, their leads are connected together and then connected to the insulated banana plug and also to the Amphenol connection via a wire that runs centrally through the cluster of capacitors. A 200 kilo-ohm, one-watt resistor is connected from the insulated banana plug connection to the grounded banana plug. In the photograph a toggle switch is shown in series with this resistor. The switch is used to disconnect the resistor when the divider is used to measure sixty-hertz voltages.

The ground collector ring can be made from a short length of 1-1/2" copper tubing, one end of which is sawed and formed into supporting feet which are bolted to the minibox with the 1/4 x 20 bolts.

The 8 μF C_2 will be obtained by using the 5 and 3 μF units in parallel. Both will be connected to the bottom end of the C_L and the deflection cable will be connected to the 5 μF unit.

Bleeder Resistors (R_L) For Load Capacitors

These resitors are shown in photograph 3. They are made up of a number of 680 kilo ohm, 2 watt carbon resistors. The resistors are mounted in a zigzag pattern on a strip of insulating material 2-1/2" wide and the height of one capacitor in length. Holes are drilled 1/4" in from the edge and spaced so as to give a pitch of 1-1/2" to the zigzag. Connection pins are placed in the holes and the resistors soldered into place.

Since the capacitors are 52-1/4 inches tall, the number of resistors per capacitor will be about 50/0.75 or 67. The end plates of the capacitors are drilled and tapped to support the strips and make electrical connections.

Precision DC Power Supply

This is a Fluke 412B power supply rated 2100 volts, 30 milliamperes. This is more voltage than needed but they have discontinued the lower voltage units.

The power supply will be connected to the binding post at the top rear of the 507 oscilloscope and the Position Mode knob will be turned to External.

Oscilloscope

When testing, the attenuator switch on the 507 scope must be in the direct position in order to disconnect the 75 ohm terminating impedance. No ratio adjustments can be made at the oscilloscope. Sweep speeds for switching surge waves are usually selected as 50 μs/cm or 100 μs/cm for viewing the front and 200 or 500 μs/cm for viewing the tail. For reading the crest of wave, 100 μs/cm is a good compromise.

A. F. Rohlfs
October 7, 1976

-ng

Attach.

cc: JG Anderson
FJ Turner

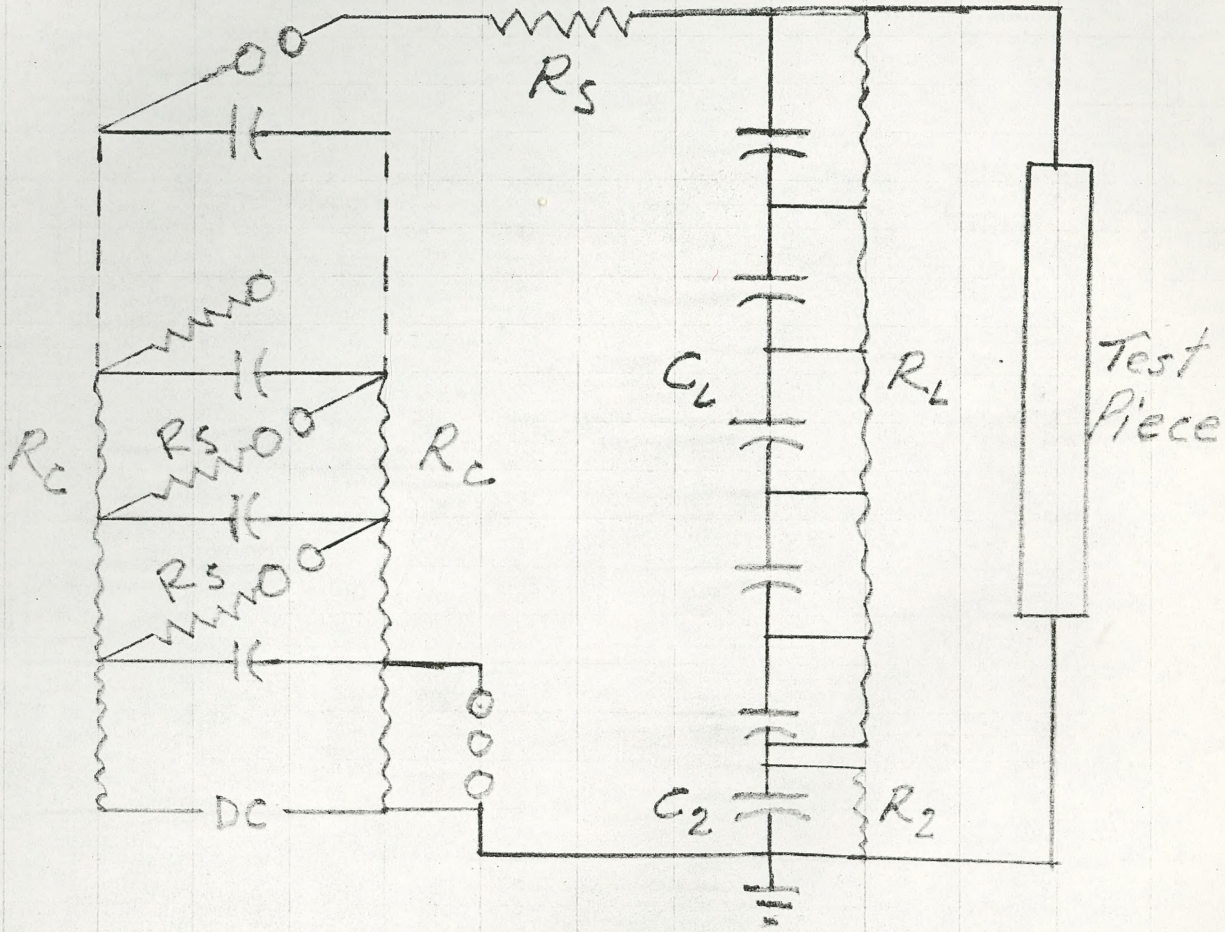


FIG 1 - SWITCHING IMPULSE CIRCUIT

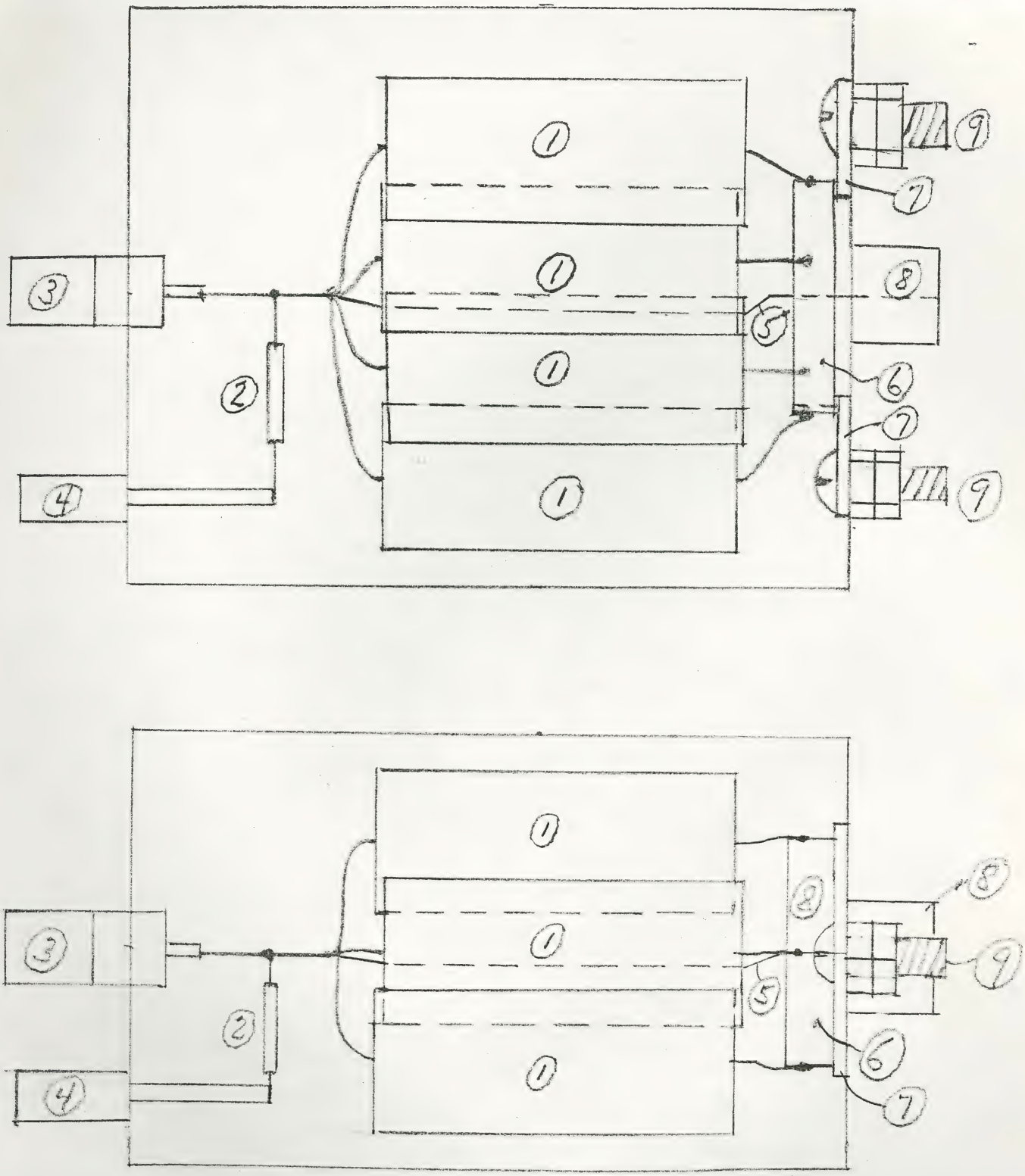
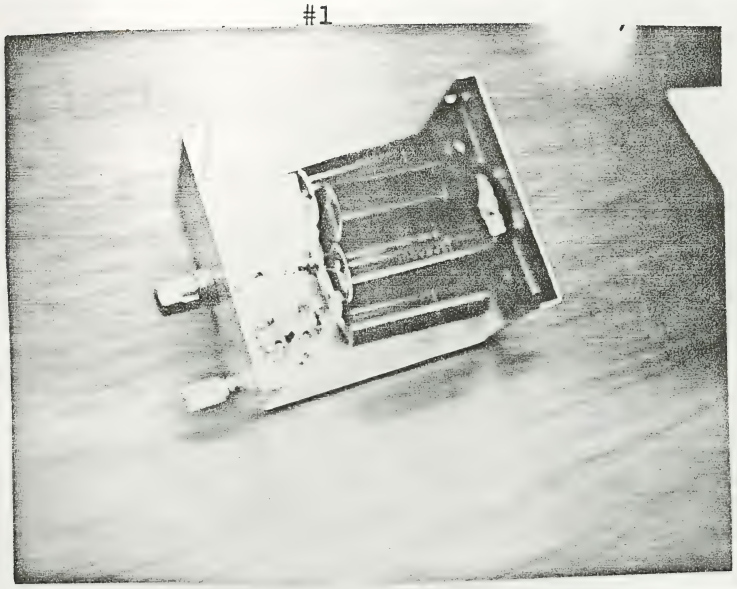
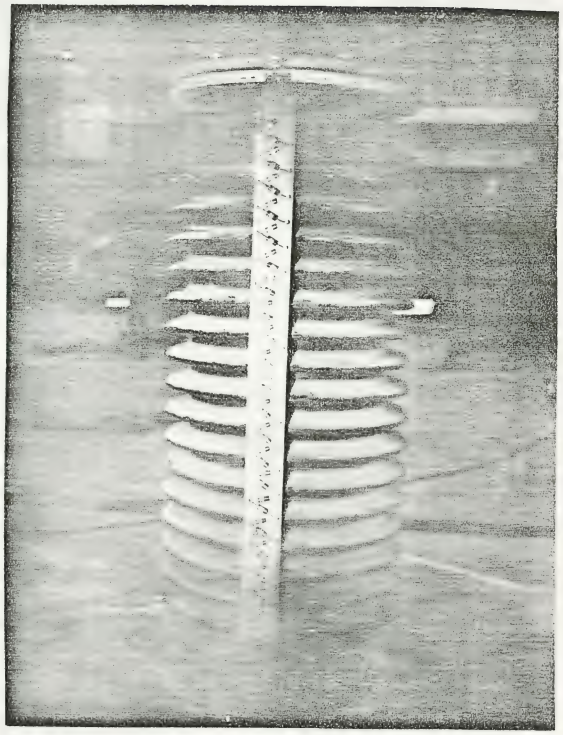


FIG. 2 - C_2 BOX

Full Scale
AF Rothlis
7/9/76

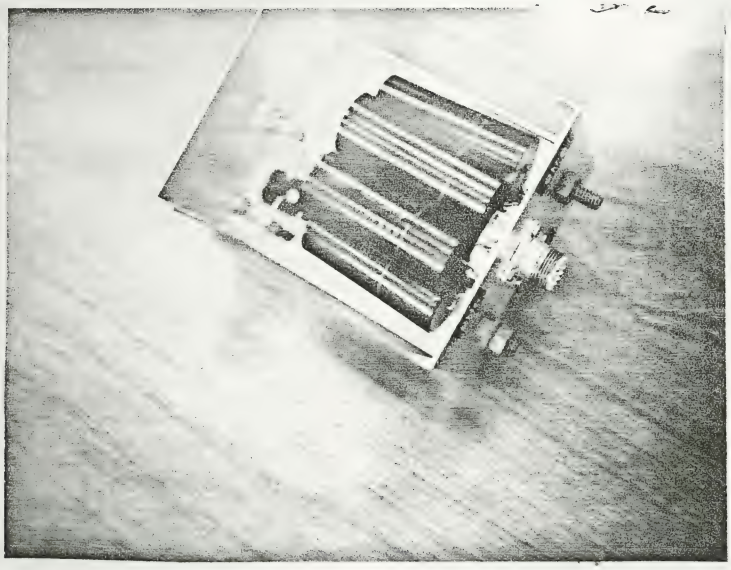
#1





#3

#2



COSTS

Load Capacitor (C_L)

(5) GE Cat. No. 4CW35C5 coupling capacitors @ $1381.	$ 6,905
Delivery 10-12 weeks	

Series Resistance (R_s)

(50 + 20 spare) 1000 ohm IRC resistors Type RW11(175 watts) @ $4.25.	298
Delivery 6-8 weeks. Add mounting clips in generator	In House
	$ 7,203

Charging Resistors (R_c)

(124 + 26 spares) 15000 ohm IRC resistors, Type RW11(175 watts) @ $4.75	713
Delivery 6-8 weeks	
	713

C_2 Capacitors

5 μF and 3 μF units

(8 + 2 spares) 1 μF, 600 volts Sprague Type 161P Black Beauty capacitors @ $2.00	20

2 μF units

(4 + 1 spare) 0.5 μF, 600 volts Sprague Type 161 P Black Beauty capacitors @ $1.50	8

1.2 uF Unit

(6 + 1 spare) 0.2 μF, 600 volts Sprague Type 161 P Black Beauty capacitors @ $1.00	$ 7
(4 + 2 spares) 200 kilo ohms (1 watt) Bleeder Resistors	
(4 + 1 spare) Insulated Banana Plug Plug Receptacle	
(4 + 1 spare) Grounded Banana Plug Receptacle	20
(4 + 1 spare) chassis mounted Amphenol	
(4) Female Connectors UHF 83-1R	
Miniboxes	
Miscellaneous Hardware	
	55

Bleeder Resistors (R_L)

(335 + 65 spares) 680 kilo ohms, 2 watt carbon resistors (10% tolerance	400
Insulating strips Connection pins Miscellaneous hardware	20
	420

Precision DC Power Supply

(1) Fluke 412B DC power supply 2160 volts, 30 milliamperes	745
Delivery 2 weeks	

Where to order major items

Load Capacitor (C_L)

General Electric Co.
Lynchburg, Va.

Can contact Bob Aideldinger - 8-272-2418

Series Resistors and Charging Resistors

IRC Boone Division
Greenway Rd.
P. O. Box 393
Boone, N. C. 28607

Tel. (704) 264-8861

C_2 Capacitors

Sprague Electric Co.
North Adams, Mass.

Precision DC Power Supply

John Fluke Mfg. Co., Inc.
P. O. Box 43210
Mount Lake Terrace
Washington, D. C. 98043

Tel. (206) 774-2211

17

A. F. Rohlfs
October 7, 1976

HASE ORDER

SHIP TO
(SEE SHIPPING INSTRUCTIONS BELOW)

LOCKE INSULATORS

LOCKE INSULATORS, INC.
2525 INSULATOR DRIVE
BALTIMORE, MARYLAND 21230
Phone (301) 752-8020

6

DATE	ROUTING	MARK ALL DOCUMENTS & PACKAGES FOR GATE NO.	PURCHASE ORDER NO.
			22717

DELIVERY REQUIRED	TERMS	F.O.B.	ADDRESS ALL CORRESPONDENCE TO 2525 INSULATOR DRIVE BALTIMORE, MD. 21230 Attn.

ITEM	QUANTITY	DESCRIPTION	PRICE
		Perform Switching Impulse	
		Flashover Tests on three	
		strings of Suspension Insulators	
		in accordance with the	
		Bonneville Power Administration	
		Specifications, copy attached	
		Insulators furnished by Locke Insulators	
		Tests scheduled to begin Oct 25, 1976	

PARCEL POST SHIPMENTS NOT TO BE INSURED UNLESS SPECIFIED

☐ SUBJECT TO MARYLAND SALES OR USE TAX

☐ NOT SUBJECT TO MARYLAND SALES OR USE TAX LICENSE NO. B-82993

APPROVED BY ______________________
AUTHORIZED SIGNATURE

COMMENTS:

2816

DATE ORDERED	DATE WANTED	DELIVER TO	SIGNED (REQUESTORS)	APPROVALS
10/1/76	10/25/76	H.V. Lab	[illegible]	[illegible]

SUGGESTED VENDORS

1. High Voltage Laboratory
2. GE Co Pittsfield Mass
3. Attn Mr Fred Turner

EST. COST

ACCOUNT NO.
29102-5-28-98

VERBAL ☐ INVOICE APPROVAL ______________________

REQUESTOR'S COPY 1

LI-218 (4-75

SWITCHING IMPULSE TESTS

Cat 365355 G 402

5-3.2 SWITCHING IMPULSE FLASHOVER CHARACTERISTICS OF INSULATOR STRINGS. The rated critical-impulse flashover voltage with a positive polarity 150/2500 switching impulse shall be as shown below for the insulator strings specified:

a. Twenty-unit string of 6-1/4 x 11-inch, 36,000 lb M and E rating insulators and

Nineteen-unit string of 6-1/2 x 12-5/8-inch, 40,000 lb M and E rating insulators:

1210 kV, dry; 1130 kV, wet

b. Twenty one-unit string of 7-3/4 x 12-5/8-inch, 40,000 lb M and E rating insulators:

1450 kV, dry; 1450 kV, wet

Plan 5 - Three strings of each size per 3-3.2 made up of randomly chosen units will constitute a sample. If any string fails to meet the requirement, a second sample of six more strings shall be tested. If any string of the second sample fails, the design shall be rejected.

Plan 6 - Sample size shall be five [illegible]

5-5.1.11 Switching Impulse Tests. Insulators from the first lot shall be subjected to switching impulse tests. The tests shall be performed on the insulator strings specified in 5-5.2 in accordance with the procedures specified below to determine the critical-impulse flashover voltage.

5-5.1.11.1 Each string of insulators shall be subject to switching impulses under both dry and wet conditions with a positive polarity 150/2500 wave. Switching impulse tests shall be performed in accordance with the applicable procedures of ANSI C29.1, C68.1, and C68.2. Oscillographic records shall be furnished as part of the test report. Failure of the average critical-impulse flashover value of the strings to equal or exceed 92 percent of the rated critical-impulse flashover value specified in 5-5.2 shall constitute failure to meet the requirements of the switching impulse tests.

Ed Schramm
Al Roberts
Fred Turner

2775

PO-22717

LOCKE INSULATORS, INC.

AUTHORIZATION AND EXPENDITURE RECORD

CHG. ACCT. NO. 293-370-01
DATE ISSUED Sept. 3,1976
DATE COMPLETED

REMARKS Development Authorization

AUTHORIZATION NO. 293-370-01
EST. COST: MATERIAL
LABOR
OUTSIDE EXPENDITURE
TOTAL $2,500.00

PLEASE AUTHORIZE THE FOLLOWING: (SHOW IN BODY COMPLETE DETAIL OF EXPENDITURE AND WORK TO BE DONE)
PLEASE DO THE FOLLOWING WORK:

This authorization is written to cover the cost of Consultation Service of Mr. Al Rolphs, General Electric Co., Pittsfield, Massachusetts, and associated travel costs from Pittsfield to Baltimore and return.

The consultation and associated services are for the purpose of establishing the capability of making Switching Surge Tests in the High Voltage Laboratory in Baltimore.

PO # 22347 covers service

1st Bell Invoice M-5808 11/22/76 145.73

SEP 7 1976

DISTRIBUTION: BE Kingsbury
FC Vose
General Acctg.
Cost
Purchasing

ISSUED BY: Fred C. Vose
F.C. Vose

APPROVED BY: B.E. Kingsbury 9/3

FORM LI-274 (3-74)

LOCKE INSULATORS, INC.

AUTHORIZATION AND EXPENDITURE RECORD

CHG. ACCT. NO. See Below
DATE ISSUED Oct. 18, 1976
DATE COMPLETED December, 1976

REMARKS ~~XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX~~
Program #98 Category I

AUTHORIZATION NO. 768
EST. COST: MATERIAL
LABOR
OUTSIDE EXPENDITURE
$3 750
~~XXXXXX~~ TOTAL 10% Contingency 375
$4 125

PLEASE AUTHORIZE THE FOLLOWING: (SHOW IN BODY COMPLETE DETAIL OF EXPENDITURE AND WORK TO BE DONE)
PLEASE DO THE FOLLOWING WORK:

Funds are requested to purchase the required material and have fabricated certain special components to give the High Voltage Laboratory the equipment to make Switching Surge tests.

Cost Analysis

Item	Investment	Expense	Total
Series Resistors	--	325	325
Charging Resistors	--	725	725
Bleeder Resistors	--	400	400
Capacitors and Hardware	--	200	200
Miscellaneous Hardware	--	500	500
Labor for Making Capacitor Boxes & Resistor Banks	--	800	800
D.C. Power Supply	800	--	
SubTotals	800	2 950	3 750
10% Contingency	80	295	375
Totals	880	3 245	4 125

CHARGE ACCT. NO.

INVESTMENT - 768-293-890-1-98
490 TAX ON INVEST - 293-383-05-768-98
MODIFY EQUIP. - 293-356-01-768-98
NEW MISC. EQUIP. - 293-303-01-768-98

DISTRIBUTION: FC Vose
BE Kingsbury
General Accounting
Cost
Machine Shop

ISSUED BY: Fred C. Vose
APPROVED BY: [illegible] 10/19

LOCKE INSULATORS, INC.

AUTHORIZATION AND EXPENDITURE RECORD

CHG. ACCT. NO. See Below
DATE ISSUED Oct. 18, 1976
DATE COMPLETED December, 1976

REMARKS ~~XXXXXXXXXXXXXXXXXXXXXXXXXXXX~~
Program #98 Category I

AUTHORIZATION NO. 768
EST. COST: MATERIAL
LABOR
OUTSIDE EXPENDITURE
$3 750
~~XXXXXX~~ TOTAL 10% Contingency 375
$4 125

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Bleeder Resistors	--	400	400
Capacitors and Hardware	--	200	200
Miscellaneous Hardware	--	500	500
Labor for Making Capacitor Boxes & Resistor Banks	--	800	800
D.C. Power Supply	800	--	
SubTotals	800	2 950	3 750
10% Contingency	80	295	375
Totals	880	3 245	4 125

CHARGE ACCT. NO.

INVESTMENT - 768-293-890-1-98
4% TAX ON INVEST - 293-383-05-768-98
MODIFY EQUIP. - 293-356-01-768-98
NEW MISC. EQUIP. - 293-303-01-768-98

DISTRIBUTION: FC Vose
BE Kingsbury
General Accounting
Cost
Machine Shop

ISSUED BY: Fred C. Vose
APPROVED BY: [illegible] 10/19

SWITCHING IMPULSE TESTS

36,000 lb insulator

5-3.2 SWITCHING IMPULSE FLASHOVER CHARACTERISTICS OF INSULATOR STRINGS. The rated critical-impulse flashover voltage with a positive polarity 150/2500 switching impulse shall be as shown below for the insulator strings specified:

a. Twenty-unit string of 6-1/4 x 11-inch, 36,000 lb M and E rating insulators and

Nineteen-unit string of 6-1/2 x 12-5/8-inch, 40,000 lb M and E rating insulators:

1210 kV, dry; 1130 kV, wet

b. Twenty one-unit string of 7-3/4 x 12-5/8-inch, 6[illegible],000 lb M and E rating insulators:

[illegible] kV, dry; 1450 kV, wet

Plan 5 - Three strings of each size per 3-3.2 made up of randomly chosen units will constitute a sample. If any string fails to meet the requirement, a second sample of six more strings shall be tested. If any string of the second sample fails, the design shall be rejected.

Plan 6 - Sample size shall be five [illegible]

5-5.1.11 Switching Impulse Tests. Insulators from the first lot shall be subjected to switching impulse tests. The tests shall be performed on the insulator strings specified in 5-5.2 in accordance with the procedures specified below to determine the critical-impulse flashover voltage.

5-5.1.11.1 Each string of insulators shall be subject to switching impulses under both dry and wet conditions with a positive polarity 150/2500 wave. Switching impulse tests shall be performed in accordance with the applicable procedures of ANSI C29.1, C68.1, and C68.2. Oscillographic records shall be furnished as part of the test report. Failure of the average critical-impulse flashover value of the strings to equal or exceed 92 percent of the rated critical-impulse flashover value specified in 5-5.2 shall constitute failure to meet the requirements of the switching impulse tests.

2775

GENERAL ELECTRIC

GENERAL ELECTRIC COMPANY, 100 WOODLAWN AVE., PITTSFIELD, MASS. 01201
Phone (413) 494 3577
(EXT.)

TRANSFORMER AND
DISTRIBUTION
EQUIPMENT
BUSINESS DIVISION

August 12, 1976

Mr. F. C. Vose
Locke Insulators, Inc.
2525 Insulator Drive
Baltimore, Md. 21230

Dear Fred:

John Anderson has asked me to reply to your request for someone from the High Voltage Laboratory to help you get set up for switching surge testing. That person will be either Fred Turner or me.

I estimate that it will cost $2000 plus the cost of one or possibly two trips to Baltimore. The first trip would be to get familiar with your laboratory. The second trip might be needed to assist in the final set up. I would anticipate that one day would be spent in Baltimore on each trip. The rest of the time would be spent in Pittsfield preparing specifications and sketches for the additional equipment you will need.

Sincerely yours,

A. F. Rohlfs

-ng

cc: JG Anderson
EC Momnie
EC Schrom
FJ Turner

To run Tests
$2775 per Ed Schramm
telephone 8/24/76

Fred Turner 8-732-3165 - Says $4000

GENERAL ELECTRIC

GENERAL ELECTRIC COMPANY, 100 WOODLAWN AVE., PITTSFIELD, MASS. 01201
Phone (413) 494 3577
(EXT.)

TRANSFORMER AND
DISTRIBUTION
EQUIPMENT
BUSINESS DIVISION

August 12, 1976

Mr. F. C. Vose
Locke Insulators, Inc.
2525 Insulator Drive
Baltimore, Md. 21230

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Sincerely yours,

A. F. Rohlfs

-ng

cc: JG Anderson
EC Momnie
EC Schrom
FJ Turner

Switching Surge Test -

Fred Turner ~~18th~~ 19th 25th

(3) 20 unit string 36,000 lb units Bonnardi

Rated critical impulse F.O. positive polarity
Must equal 93% of rating 1210 kv dry, 1150 wet
Oscillograph required
Wave shape 150/2500

Witness of hypothesis instruction
Use Pittsfield Trench

Hi Volt Lab Bldg 9 -
100 Woodlawn Ave
G E Pittsfield 02201
Attn Fred Turner

PO # Mfgmp $4000

Charge 29102 - 5 - 28 - 98

November 5, 1975

Dale Electronics
1354 Twenty-eighth Avenue
Columbus, Nebraska 68601

Gentlemen:

We are interested in purchasing noninductive card resistors for use with circuitory on impulse generators, and we understand you manufacture these items. We would, therefore, appreciate receiving a catalog, or other descriptive literature, together with pricing on these items.

Very truly yours,

Fred C. Vose
Manager-High Voltage
Laboratory

FCV/lan

November 5, 1975

Ohmite Manufacturing Company
3604 Howood Street
Skokie, Illinois 60076

Gentlemen:

We are interested in purchasing noninductive card resistors for use with circuitory on impulse generators, and we understand you manufacture these items. We would, therefore, appreciate receiving a catalog, or other descriptive literature, together with pricing on these items.

Very truly yours,

Fred C. Vose
Manager-High Voltage
Laboratory

Do not make card resistors per this letter

FCV/lan

November 5, 1975

Eastern Precision Resistor Division
Cardwell Condense Corporation
Lindenhurst, New York 11757

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FCV/lan

Gen = 37.5 K watt sec

...tored in a Capacitor W

$\frac{1}{2} C E^2 10^{-6}$

...ergy in joules (watt seconds)

...pacitance in microfarads

...tential difference between electrodes
in volts.

Eastern Precision Resistor Div.
Cornell Dubilier Corp. [?]
Lindenhurst N.Y. 11757
Tel 516-884-4300

Sell [?]
Ed Schrom or Carl Lee [?]

IRC Resistors - Internal resistors [?]
International Resistor Co
Box 393 Boone N.C. 704-264-8861
Balto Enterprise 9-3155

Ohmite Mfg Co.
Skokie, Ill.
3604 Howard St. 60076
312 - 675 - 2600

Dale Eectronics Columbus, Neb
1354 - 28th Ave 68601
402 - 564 - 3131

Bus, Weld.
01

Gen = 37.5 K watt sec

Energy stored in a Capacitor W

$$W = \tfrac{1}{2} C E^2 10^{-6}$$

W = Energy in joules (watt seconds)

C = Capacitance in microfarads

E = potential difference between electrodes in ~~ft~~ volts.

IRC Resistors = Internal resistors
International Resistor Co
Box 393 Boone N.C. 704-264-8861
Bolt Enterprises 9-3155

Bombs in parallel

$$V = LSV \times R_{ratio} \times \sqrt{2} \times 2 \times 10$$

~~780 000~~

$$LSV = \frac{780,000}{143.2 \times 1.414 \times 20} = 192.6 \text{ Volts}$$

For 11 (71 KV)

$$W = \tfrac{1}{2} \times .33 \times \overline{71{,}000}^{2} \times 10^{-6}$$

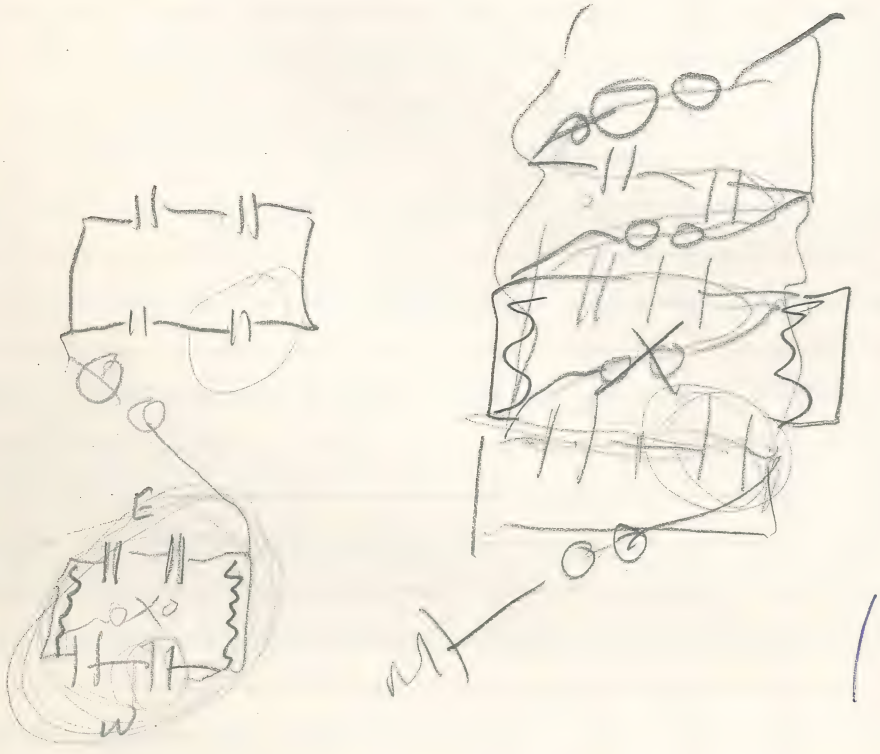
$$= 831 \text{ watt sec}$$

$$= .831 \text{ Kilowatt Sec}$$

Total $W = .831 \times 11 = 9.14$ kilowatt sec

$$\overset{40}{\cancel{10}} \times \frac{1}{\cancel{2}} \times \frac{1}{3} \times \frac{(\cancel{78})^{2}}{\cancel{(10)}6} \qquad \left(\frac{1}{4}\right)$$

78 x 10



Use (19) in parallel (38)

Voltage = 780/19 = 41 KV/cm

$W = \frac{1}{2} \times .33 \times \overline{41,000^2} \times 10^{-9} = .277$ Kwatt sec

Total W = .277 × 38 = 10.526 Kwatt sec

Use (18) in parallel

Voltage = 43.33 KV/cm

$W = \frac{1}{2} \times .33 \times \overline{43,333^2} \times 10^{-9} = .309$ Kwatt sec

total W = 36 × .309 = 11.124

Use (16) in parallel (32)

Voltage = 780/16 = 48.75 KV/cm

$W = \frac{1}{2} \times .33 \times \overline{48750^2} \times 10^{-9} = .392$ Kwatt Sec

total W = .392 × 32 = 12.54 Kwatt Sec.

Use 20 in parallel (40) cms

Voltage = 780/20 = 39 KV/cm

$W = \frac{1}{2} \times .33 \times \overline{39000^2} \times 10^{-9}$ = .250 Kwatt Sec

Total W = 40 × .250 = 10.0 Kwatt Sec.

Time _____ Date _____

WB _____ DB _____ Bar _____

RAD _____ VP _____ H _____

Precision DC Supply

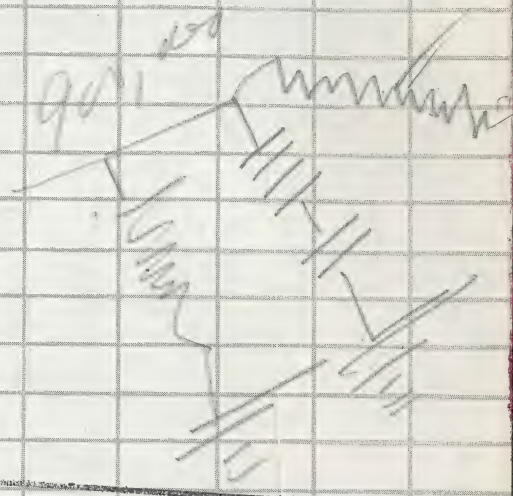
Model 301 E

John Fluke Mfg Co.

Charging resistor 690K

1 97 K

8-272-9202



Left Page

KV BANK	μSEC CM	R_1 POS	SCOPE TAP	C_2 MFD	RATIO	POL	IMPULSES
CREST SCOPE VOLTS	CREST KILOVOLTS		CHOP TIME MICROSECONDS				REMARKS

Right Page

Breaks →

KV BANK	μSEC CM	~~R_1 POS~~	SCOPE TAP	C_2 MFD	RATIO	POL	IMPULSES	o/o F.O
LSV	50	Direct	3.77	349	Pos		F o F 40	
							F F o	

Scope (volts varied)

CREST SCOPE VOLTS/cm	~~CREST KILOVOLTS~~	KV/micron CHOP TIME MICROSECONDS	REMARKS
430	385	KV	o/o F.O
Full wave	2.8 KV clipped wave	Microsec	

$$\text{Ratio} = \frac{\text{Ratio} \times \text{scope volts}}{\text{microsec/cm} \times \text{cm from crest volt scope}}$$

Take 20 shots record F.O. ~~[illegible]~~ or withstand, get average withstand - and average crest F.O.

In taking readings crest scope volts / time to chop at chop in cm x micro sec / cm then KV / micro sec ↑

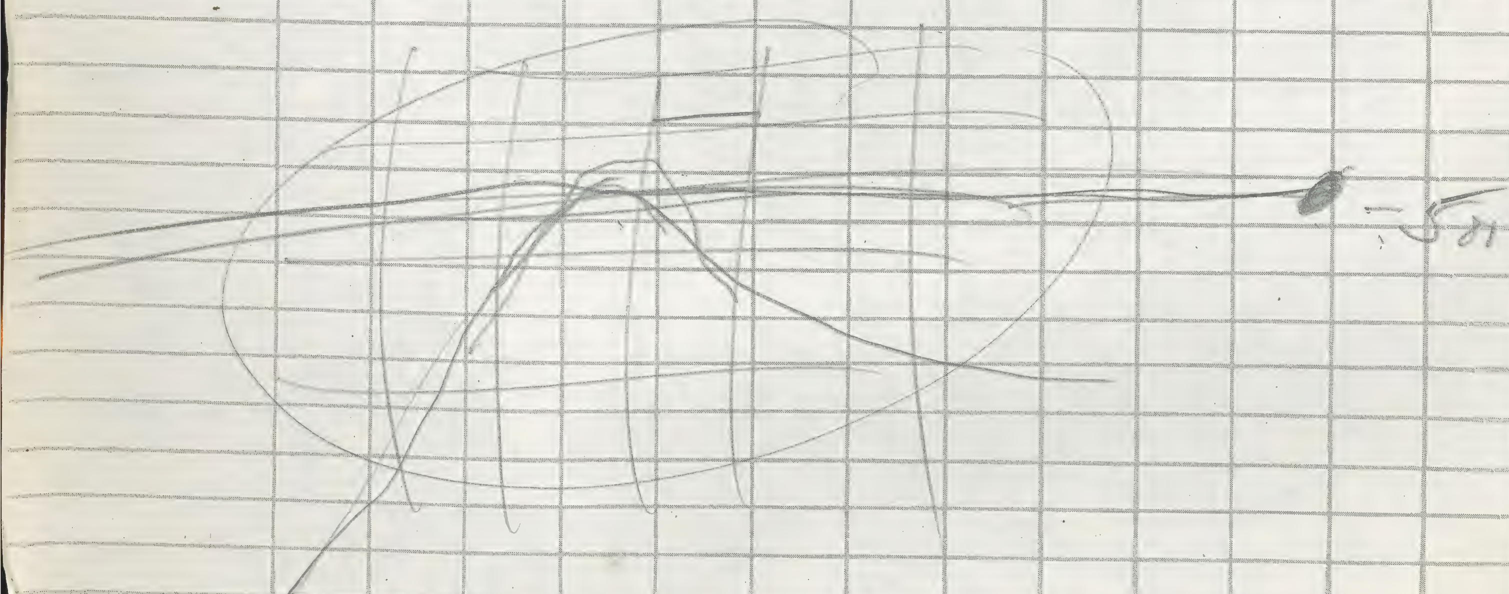
In setting up make equal space for

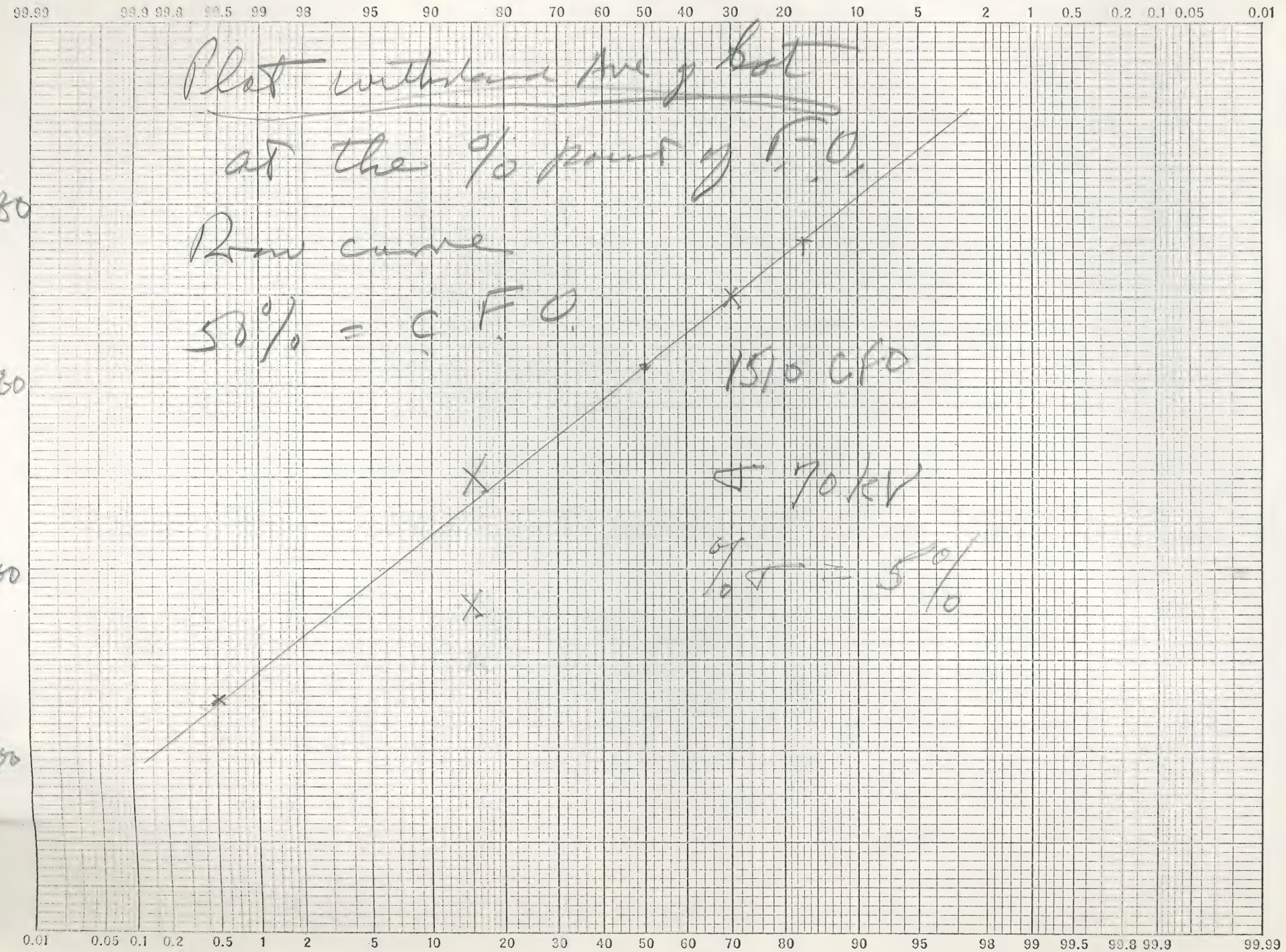
Crest Scope Volts KV / micro sec

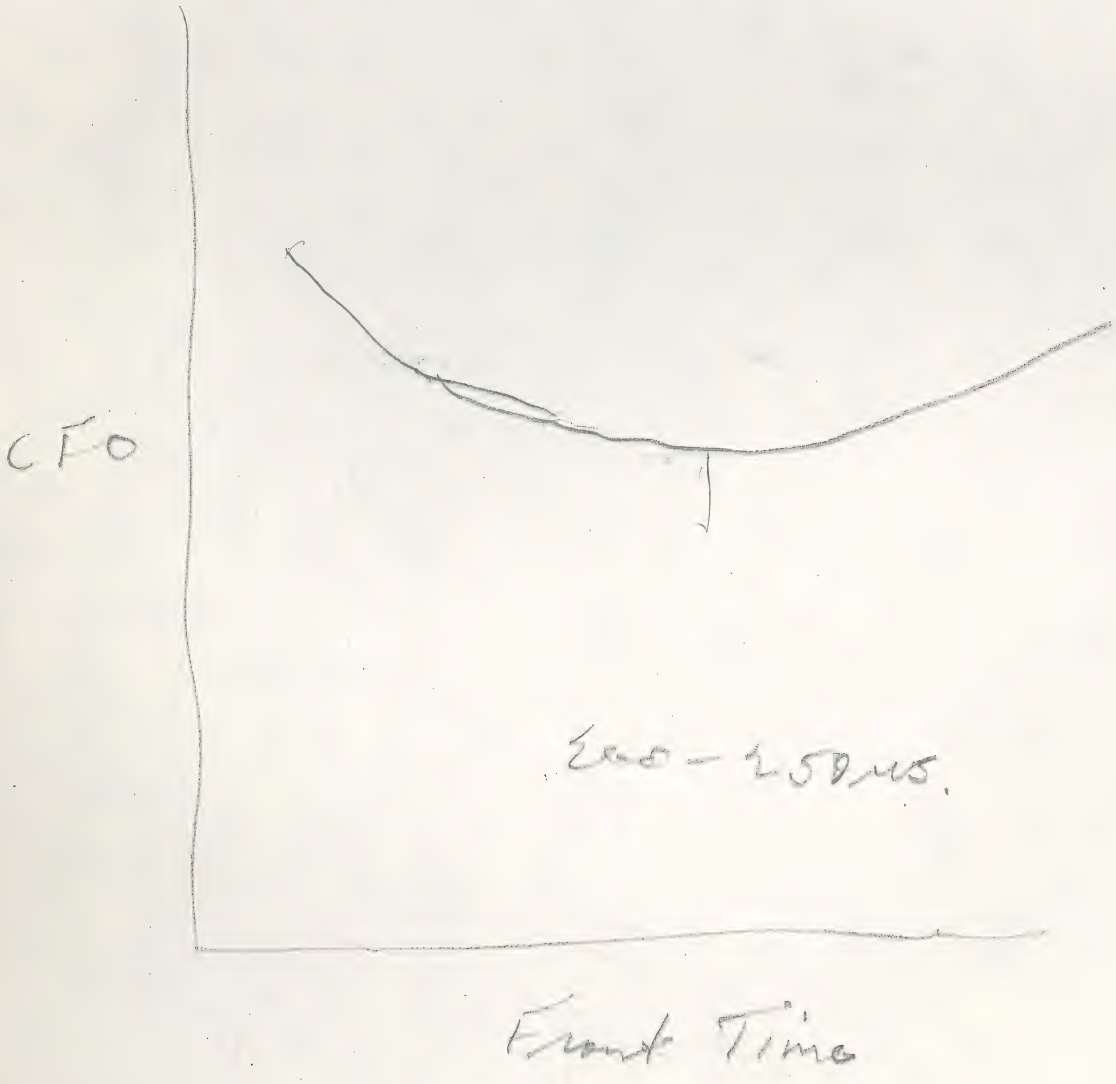
Plot Ave withstand of the 20 last shots and curve.

String Numbers ground end to hot end	1st string tested	1 - 20
	2nd "	21 - 40
	3rd "	41 - 60

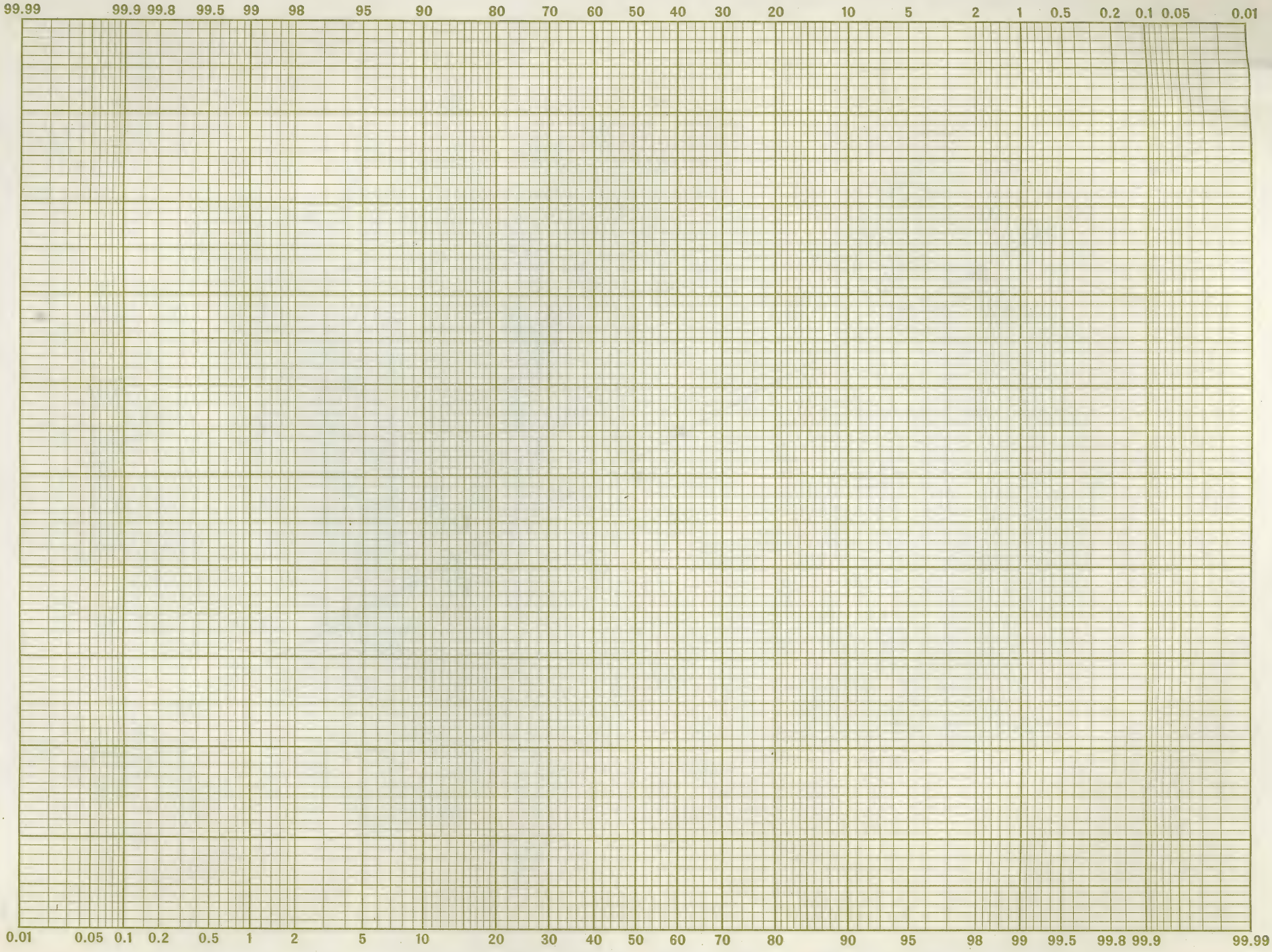
Ratiometer Cost

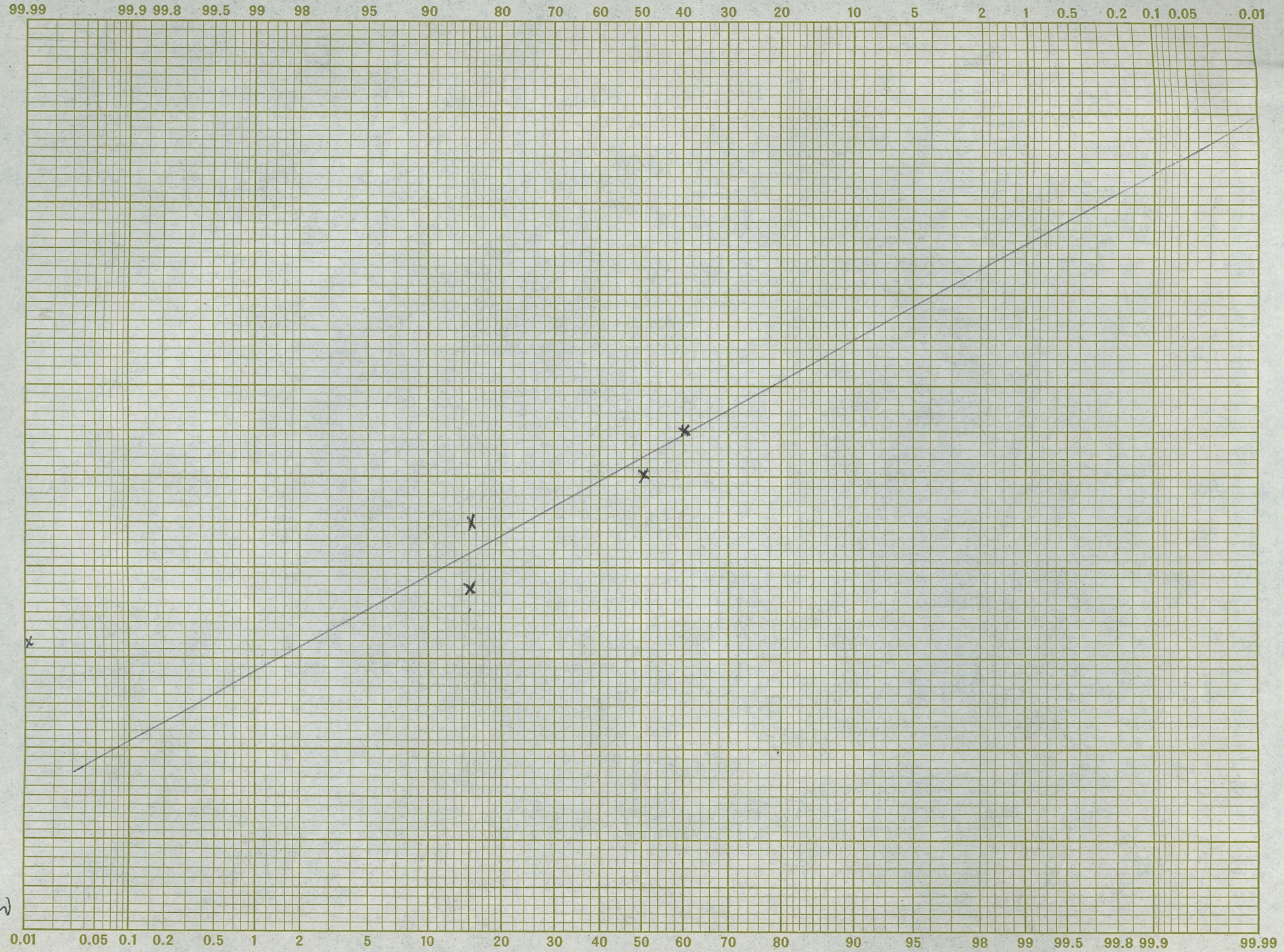





CFO
200 – 250 ms.
Event Time

NO. 3127 ARITHMETIC PROBABILITY, DESIGNED BY HAZEN, WHIPPLE & FULLER.
codex GRAPH PAPER ® IN STOCK DIRECT FROM CODEX BOOK CO. INC. NORWOOD, MASS. 02062
PRINTED IN U. S. A.





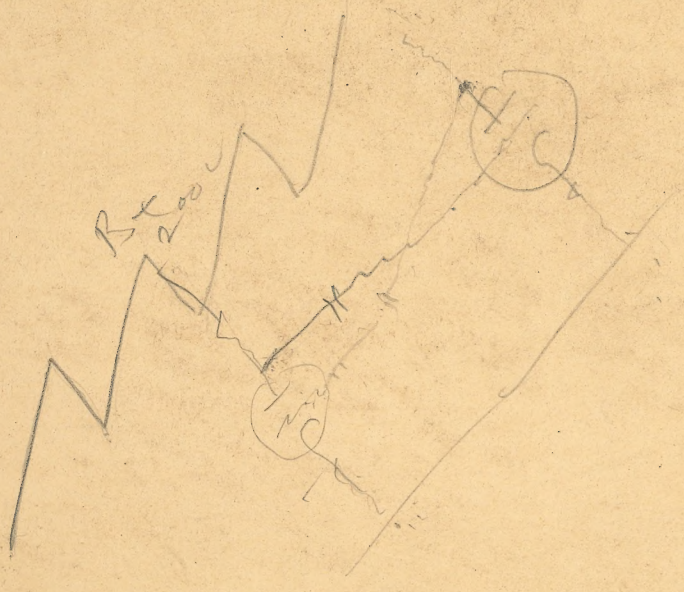
Development & Investigation

Funds are requested to purchase the required materials and have fabricated custom special components to give the High Voltage laboratory the equipment to make Switching Surge tests.

Cost Analysis -

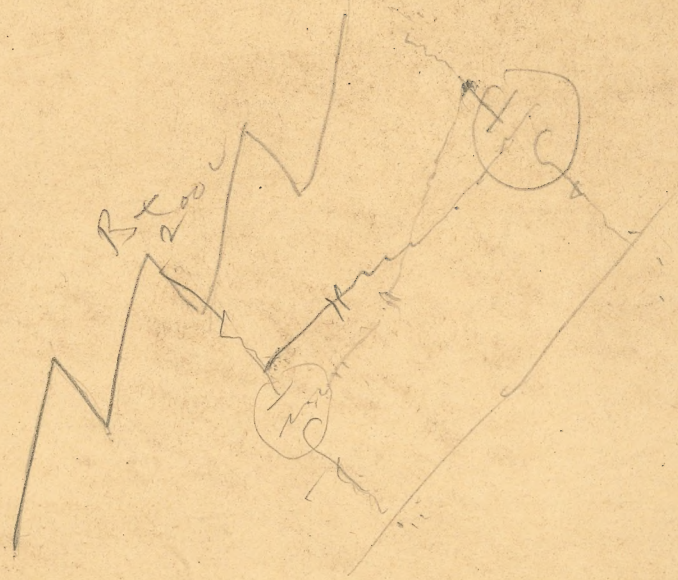
Item	Investment	Expense	Total
Series Resistor	—	325	
Charging Resistors		725	
Bleeder Resistors		400	
Capacitors and hardware		200	
Miscellaneous hardware		500	
Labor for Making Capacitor boxes and Resistor Banks		800	
D.C. Power Supply	800	—	
Sub totals	800	2950	
10% Contingency	80	295	
Totals	880	3245	4125

Very



pos. — ||| ||| ||| ||| |||
neg. — ||| ||| ||| ||| |||

Impulse Generator



pos. 𝍸 𝍸 𝍸 𝍸 𝍸 |||

neg. 𝍸 𝍸 𝍸 𝍸 ||||